SP-W1 Project Effects on Water Quality Designated Beneficial Uses for Surface Waters

October 25, 2002

1.0 Introduction/Background

The Environmental Work Group identified as an issue the effects of existing and future project operations on the physical, chemical, and biological components of water quality in the Feather River, affected tributaries, and downstream waters. The project was considered to have potential for direct and indirect water quality effects on aquatic ecosystem health, recreational opportunity, and domestic and agricultural water supply. Concern was expressed about the potential effects of the project on compliance with water quality objectives identified in the Regional Water Quality Control Board's Water Quality Control Plan (Basin Plan) (CVRWQCB 1998), and effects on designated beneficial uses of the water. The beneficial uses for the reservoir and Feather River as defined in the Basin Plan include municipal and domestic supply, agriculture irrigation, electrical power production, contact and non-contact recreation, canoeing and rafting recreation, warm and cold freshwater habitat, warm and cold fish migration and spawning, and wildlife habitat.

Some physical, chemical, and biological data have been collected from the North, Middle, and South forks of the Feather River near their confluences with Lake Oroville, from the reservoir itself, and downstream from Oroville Dam in the Feather River, Thermalito Power Canal, and Thermalito Afterbay. However, these data are not, nor were expected to be, sufficient to determine compliance of project waters with all Basin Plan objectives, goals, and criteria for protection of the designated beneficial uses. Some of the existing data also indicate potential areas of concern for adverse water quality conditions. These data are identified and summarized in the Initial Information Package for Relicensing of the Oroville Facilities (DWR 2001). Additional physical, chemical, and biological data are needed to demonstrate project compliance with Basin Plan standards.

Relicensing of the Oroville Facilities by the Federal Energy Regulatory Commission (FERC) requires certification from the State Water Resources Control Board (SWRCB) that the project complies with Section 401 of the Federal Clean Water Act. The water quality certification signifies compliance with water quality standards and other appropriate requirements for any discharge or discharges to waters of the United States resulting from an activity that requires a federal license or permit. Information required by the SWRCB for certification includes evidence of compliance with appropriate requirements of the Basin Plan.

2.0 Study Objective

The objective of the study is to evaluate the physical, chemical, and biological integrity of water quality in Lake Oroville, its tributaries, the Feather River, Diversion Pool, Thermalito Power Canal, Forebay and Afterbay, and other project-affected surface waters. Information obtained from the study will be used to determine whether project-affected waters meet Basin Plan objectives and are protective of beneficial uses designated in the Basin Plan.

3.0 Relationship to Relicensing /Need for the Study

Construction of Oroville Dam, impoundment of water to form Lake Oroville, and associated facilities of the project have affected the physical, chemical, and biological characteristics of water in the Feather River. These changes in water quality characteristics may affect beneficial uses of the water.

Prior to issuance of a new license for the project, FERC will require a water quality certification by the SWRCB or a waiver of such certification. The certification requires a determination by the SWRCB that the project complies with appropriate requirements of the CVRWQCB Basin Plan, which includes water quality objectives for protection of designated beneficial uses. The CVRWQCB has established surface water quality objectives for a variety of water quality constituents, for which both numerical and narrative standards have been developed. Numerical objectives have been established for parameters which can be measured quantitatively (such as mg/L of a chemical contaminant), while narrative objectives have been established for parameters that may not be readily quantifiable (such as toxicity). Both numerical and narrative objectives are applicable in determining impacts to beneficial uses. Demonstration of compliance with water quality standards and other appropriate requirements is needed in the application for water quality certification. While compliance with numerical objectives will be determined by comparison of data to the numerical value of the objective, compliance with narrative objectives will be determined by comparison of data to other applicable criteria or standards that are recognized as levels protective of beneficial uses. Data obtained from this study will be used to determine compliance with standards, objectives, and criteria for those factors controllable by the project.

4.0 Study Area

The study area is generally within the FERC project boundary, but also includes the Feather River downstream to the confluence with the Sacramento River for project-related effects. Specific water bodies included in the study plan are the North, Middle, and South forks of the Feather River and the West Branch and Concow Creek just above their confluences with the reservoir, Lake Oroville, Feather River downstream from Oroville Dam to the confluence with the Sacramento River, Thermalito Diversion Pool, Forebay, and Afterbay, and Oroville Wildlife Area ponds.

Study plans approved by the Environmental Work Group define the limits of the study area. If initial study results indicate that the study area should be expanded or contracted, the Environmental Work Group will discuss the basis for change and revise the study area as appropriate.

5.0 General Approach

This study will evaluate those parameters potentially affected by the project for which the CVRWQCB has established water quality objectives in the Basin Plan. These parameters include physical constituents (temperature, dissolved oxygen, pH, turbidity, electrical conductivity), chemical constituents (minerals, nutrients, and metals), pesticides, pathogens (bacteria), biostimulatory substances which promote aquatic growths (phytoplankton, periphyton), toxicity (aquatic macroinvertebrate indicators and toxicity bioassays), sediment, settleable and suspended material, color, floating material, oil and grease, and tastes and odors. The study generally relies on monthly collection of data since water quality parameters vary with environmental conditions throughout the year, though some parameters are targeted to specific times of the year due to parameter specific factors. In addition, some parameters will be collected to coincide with the first flush following significant fall rains as well as during some subsequent storm events since the higher runoff associated with these events often elevate certain parameters. Data obtained from this study will be compared to numerical or narrative objectives to determine compliance with the water quality standards for factors controllable by the project. If initial study results indicate that the methods and tasks should be modified, the Environmental Work Group will discuss the basis for change and revise the study plans as appropriate.

Task 1—Project Effects on Surface Water

Monitoring will be conducted at sites within and adjacent to the study area to assess physical, chemical, and biological water quality characteristics in major inflows, discharges, impounded waters, and ponds, and to assess effects of various land use activities within the Feather River watershed project area (Figures SPW1-1 and 2, Table SPW1-1). Monitoring sites were identified in Environmental Workgroup Task Force meetings, which included participation by federal and State agencies and members of the public. Exact monitoring sites will be determined in the field during initial sampling. Site coordinates will be obtained with hand-held GPS units, and data input into the project GIS system. Adjacent areas included in the monitoring program are primarily the tributaries entering Lake Oroville and stations on the Feather River downstream to the confluence with the Sacramento River Monitoring of these tributaries at their confluences with the reservoir will establish a baseline for determining any changes in water quality induced by the project. Additional monitoring stations may be added if data indicate the need to determine sources and effects of any detected adverse habitat or water quality conditions.

Physical, chemical, and biological components of water quality will be assessed in study area waters (Table SPW1-2). Some parameters, such as temperature, will be obtained with recording instruments, while others (such as inorganic chemistry) will be sampled during monthly visits to the monitoring site.

Water Temperature—Water temperatures in the study area will be assessed since this parameter controls the rate of chemical and biological processes, and is important in determining suitability of project waters for survival and reproduction of aquatic organisms, including anadromous fish. These data will also be necessary for development of a temperature model in other study plans. This information will be collected in Study Plan SP-W6.

Field Parameters—Basic water quality parameters, including temperature, dissolved oxygen, conductivity, pH, and turbidity, will be measured with properly calibrated field instrumentation at each visit to every monitoring station. Stream samples or measurements will be collected about one foot below the surface in flowing, well-mixed riffle or run areas. Dissolved oxygen will be measured in streams by titration (azide modification of the iodometric method). Basic water quality parameters will be measured in lentic waters (lakes and ponds) from the surface to the bottom at meter intervals when differences in individual parameters are observed between successive depths, and at three to five meter intervals when there are no differences in successive values. Temperature and dissolved oxygen in lentic waters will be measured at intervals

Figure SPW1-1. Monitoring Sites in the Project area

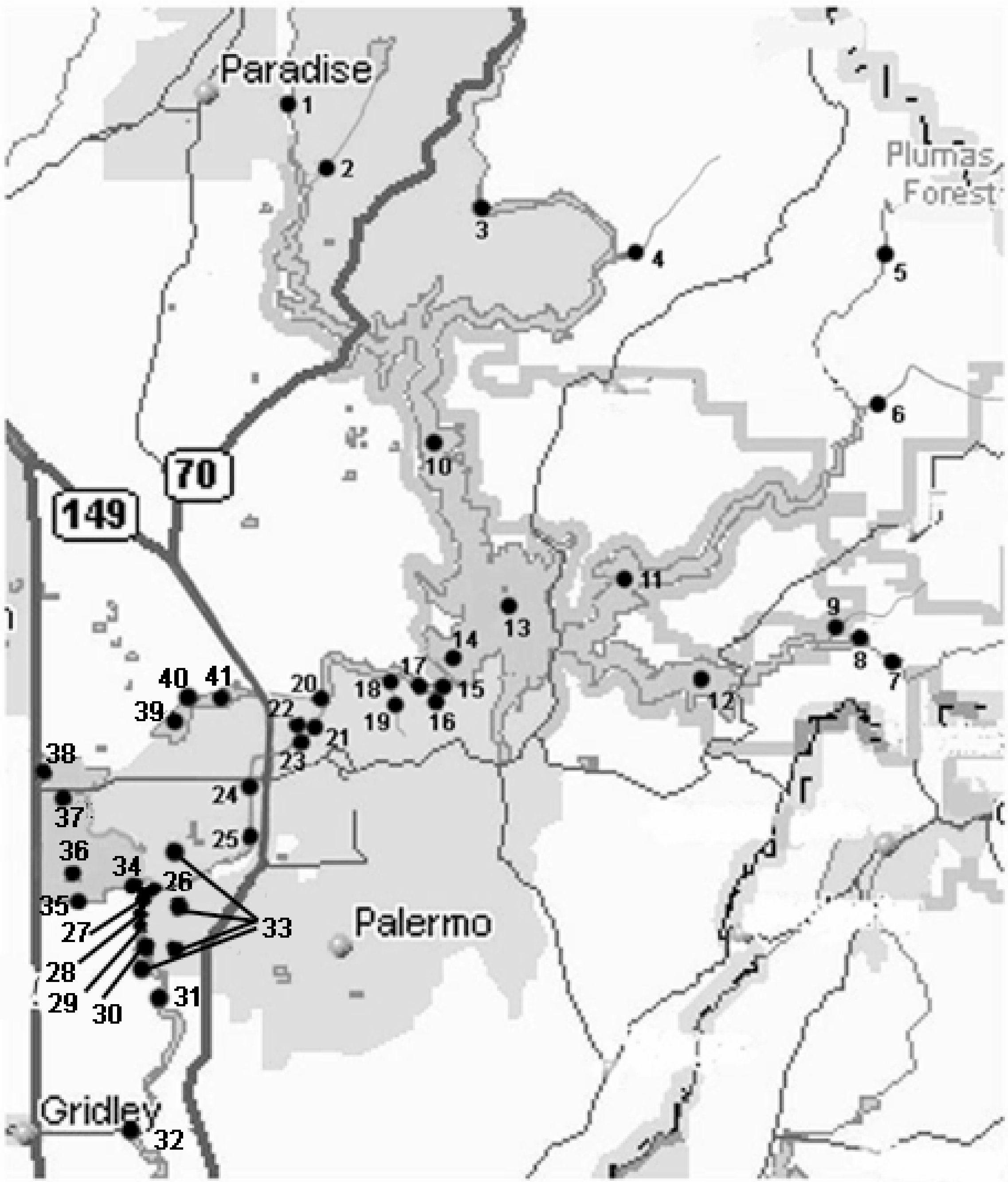

Figure SPW1-2. Monitoring Sites in the Lower Feather River

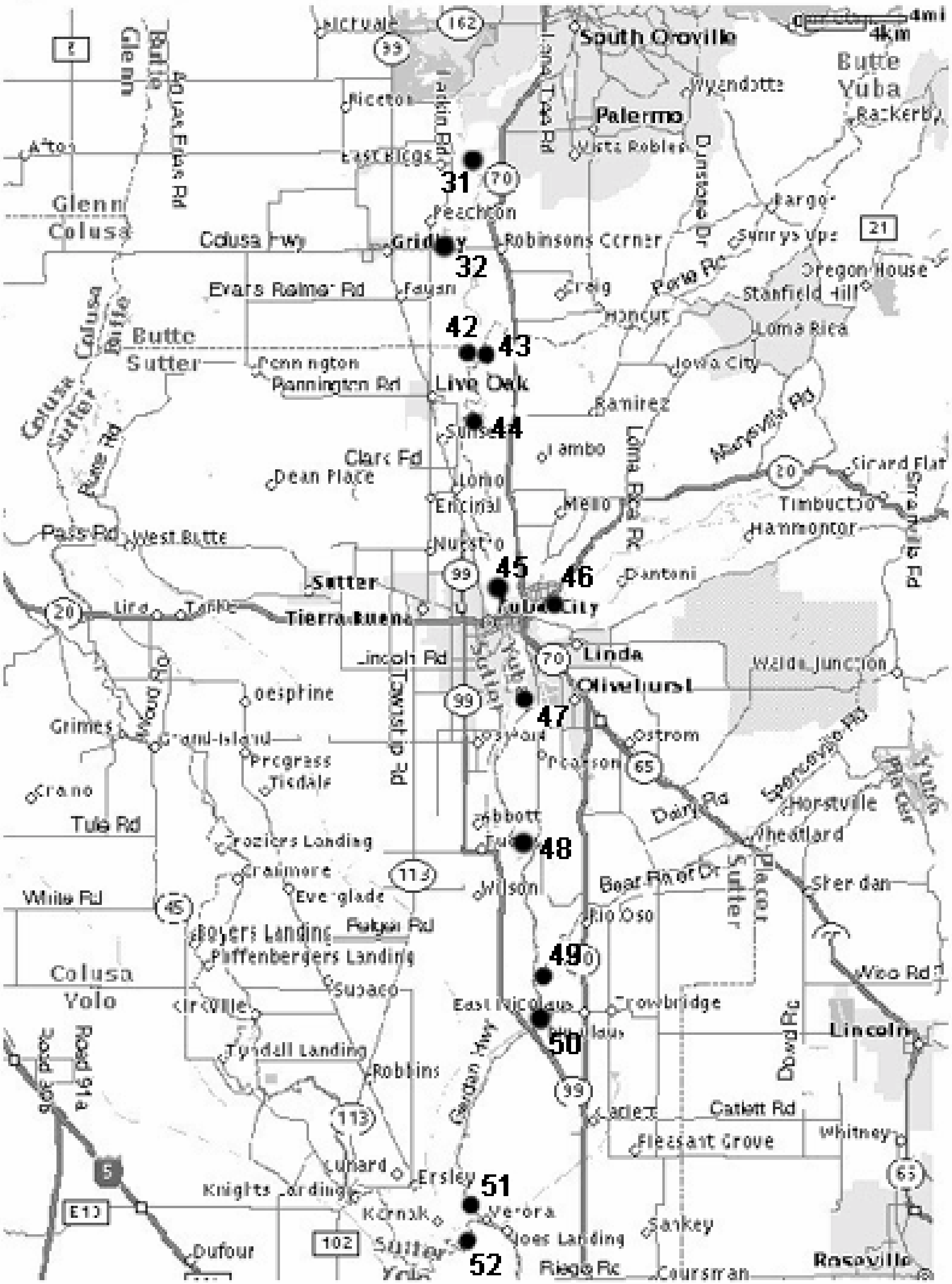

Table SPW1-1. Monitoring Site Number System for Maps

1. West Branch at Oroville Reservoir	28. Feather River downstream from Afterbay Outlet
2. Concow Creek at Jordan Hill Road	29. Feather River downstream from SCOR Outfall
3. North Fork downstream from Poe Power House	30. Feather River near Mile Long Pond
4. French Creek at Oroville Reservoir	31. Feather River downstream from Project boundary
5. Middle Fork at Milsap Bar Road	32. Feather River nr Gridley
6. Fall River upstream from Feather Falls	33. Wildlife Area ponds
7. South Fork upstream from Ponderosa Reservoir	34. Afterbay Outlet Canal to Feather River
8. Ponderosa Reservoir near Dam	35. Sutter Buttes Canal at Afterbay Outlet
9. Sucker Run near Forbestown	36. Thermalito Afterbay (south)
10. North Fork Arm Lake Oroville	37. Thermalito Afterbay (north)
11. Middle Fork Arm Lake Oroville	38. Western Canal at Afterbay Outlet
12. South Fork Arm Lake Oroville	39. Thermalito Forebay (south)
13. Lake Oroville Main Body	40. Thermalito Forebay nr Wastewater Holding Tank
14. Lake Oroville near Dam	41. Thermalito Forebay (north)
15. Diversion Pool upstream from Kelly Ridge PH	42. Feather River upstream from Honcut Creek
16. Kelly Ridge PH Discharge	43. Honcut Creek
17. Diversion Pool downstream from Kelly Ridge PH	44. Feather River near Live Oak
18. Glen Pond	45. Feather River supstream from Yuba River
19. Glen Creek	46. Yuba River at Marysville
20. Diversion Pool near Diversion Dam	47. Feather River at Shanghai Bend
21. Feather River nr Fish Barrier Dam	48. Feather River at Star Bend
22. Feather River upstream from Hatchery	49. Bear River
23. Feather River downstream from Hatchery	50. Feather River nr Nicolaus
24. Feather River downstream from Hwy 162	51. Feather River near Verona
25. Feather River at Robinson Riffle	52. Sacramento River upstream from Feather River
26. Feather River upstream from Afterbay Outlet	
27. Feather River pool at Afterbay Outlet	

using meters and membrane electrode probes calibrated at the surface using the iodometric method. Conductivity and pH will be measured with meters and probes in samples collected at intervals with a van Dorn water bottle. Turbidity will be measured with a nephelometer from samples collected using the van Dorn water bottle.

Dissolved oxygen will also be measured in pools near the sampling stations downstream from the Fish Barrier Dam to the mouth of the Feather River. Dissolved oxygen (and temperature in conjunction with SP-W6) profiles will be measured at half-meter intervals from the surface to the bottom of pools with meters and probes every other week from May through October, and monthly from November through April.

At some stations, the basic water quality field parameters may also be recorded with data loggers. Data loggers may also be installed where data indicate potential water quality degradation or where water quality parameters could be expected to experience wide diurnal variations. Logging instrumentation will be calibrated no less frequently than monthly, or more often if data indicate significant instrument drift.

Inorganic Chemistry—Water inorganic chemistry will be assessed since these parameters influence beneficial uses of water and may become elevated due to contamination, which often results in deleterious effects to aquatic life and other beneficial uses. Limnological processes in project water bodies may alter the chemical state of some parameters, and include potential release of soluble metals from bottom sediments and methylation of mercury due

Table SPW1-2. Water Quality Monitoring Schedule for the Oroville Relicensing Project

	Station	Temper -ature (a)	Field Parameters (b)	Inorganic Chemistry (c)	Pesticides (d,f)	Coliform bacteria (t)	Phyto- & Periphyton Zoo- plankton		Macro- Inverte- brates	Aquatic Toxicity
1	West Branch at Oroville Res	R	m (e)(t)	m (t)	F & W	m(t)		m	l	o
2	Concow Creek at Jordan Hill Rd	R	m (t)	m (t)	F & W	m(t)		m	l	o
3	North Fork d/s Poe Power House	R	m (t)	m (t)	F & W	m(t)		m	l	o
4	French Creek at Oroville Res	R	m							
5	Middle Fork at Milsap Bar Rd	R	m (t)	m (t)	F & W	m (t)		m	l	o
6	Fall River u/s Feather Falls	R	m (t)	m (t)	F & W	m (t)		m	l	o
7	South Fork u/s Ponderosa Res	R	m (t)	m (t)	F & W	m (t)		m	l	o
8	Sucker Run nr Forbestown	R	m (t)	m (t)	F & W	m (t)		m	l	o
9	Ponderosa Res nr Dam	P	m	m			m			
	Lake Oroville									
10	North Fork Arm	P	m	m (r)	F & W (i)	m	m			
11	Middle Fork Arm	P	m	m (r)	F & W (i)	m	m			
12	South Fork Arm	P	m	m (r)	F & W (i)	m	m			
13	Main Body	P	m	m (r)	F & W (i)	m	m			
14	Dam	P	m	m (s)	F & W (i)	m	m			
	Diversion Pool									
15	u/s from Kelly Ridge Power House	P	m	m	F & W (i)	m	m			
16	Kelly Ridge Power House discharge	R								
17	d/s from Kelly Ridge Power House	P								
18	Glen Pond	P	m	m						
19	Glen Creek	R	m	m	F & W	m		m	l	
20	Diversion Pool nr Div. Dam	P	m	m (r)	F & W (i)	m	m			
	Feather River in Project Boundary									
21	nr Fish Barrier Dam	Ru	m (g,t,u)	m (g,t)	F & W	m (t)		m (g)	l	m
22	u/s from Hatchery	Ru	m (g,u)	m (g)		m		m (g)	l	
23	d/s from Hatchery	Ru	m (g,t,u)	m (g,t)	F & W	m (t)		m (g)	l	m
24	d/s from Hwy 162 bridge	Ru	m (g,u)	m (g)		m		m (g)	l	
25	Robinson Riffle	Ru	m (g,u)	m (g)		m		m (g)	l	
26	u/s from Afterbay Outlet	Ru	m (g,t,u)	m (g,t)	F & W	m (t)		m (g)	l	m
27	pool at Afterbay Outlet	u	u							
28	d/s from Afterbay Outlet	R u	m (g,t,u)	m (g,t)	F & W	m (t)		m (g)	l	m
29	d/s from SCOR Outfall (q)	R	m (g,t)	m (g,t)	F & W	m (t)		m (g)	l	m
30	nr Mile Long Pong	Ru	m (g,t,u)	m (g,t)	F & W	m (t)		m (g)	l	
31	d/s from Project boundary	Ru	m(t,g,u)	m(g,t)	F & W	m (t)		m	l	m
32	nr Gridley	u	u							
33	Oroville Wildlife Area ponds	P	m	m	F & W (i)	m	m		l	p

	Thermalito Complex									
34	Outlet to Feather River	R	m	m	F & W (i)	m				m
35	Sutter Buttes Canal	R	m							
36	South Afterbay	P	m	m (r)	F & W (i)	m	m			
37	North Afterbay	P	m	m (r)	F & W (i)	m	m			
38	Western Canal	R	m							
39	South Forebay	P	m	m (r)	F & W (i)	m	m			
40	Forebay nr Wastewater Holding Tank					m				
41	North Forebay	P	m	m (r)	F & W (i)	m	m			
	Feather River Downstream from Project Boundary									
42	u/s from Honcut Creek	Rg,u	m(t,g,u)	m(t)	F & W	m (t)		m	l	
43	Honcut Creek	R	m(t)	m(t)	F & W	m (t)		m	l	
44	nr Live Oak	Ru	m(t,u)	m(t)	F & W	m (t)		m	l	
45	u/s from Yuba River	Ru	m(t,u)	m(t)	F & W	m (t)		m	l	
46	Yuba River	R	m(t)	m(t)	F & W	m (t)			l	
47	at Shanghai Bend	Ru	m(t,u)	m(t)	F & W	m (t)			l	
48	at Star Bend	u	u							
49	Bear River	R	m(t)	m(t)	F & W	m (t)			l	
50	nr Nicolaus	u	u							
51	nr Verona	Ru	m(t,u)	m(t)	F & W	m (t)			l	
52	Sacramento R ab FR	R	m(t)	m(t)	F & W	m (t)			l	

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Table SPW1-2. Water Quality Monitoring Schedule for the Oroville Relicensing Project, continued

a. R = recorder, P = profile; from study plan SP-W6
b. Includes dissolved oxygen, conductivity, pH, turbidity
c. minerals (calcium, sodium, potassium, magnesium, sulfate, chloride, boron, and alkalinity), nutrients (nitrate plus nitrite, total and dissolved ammonia, dissolved orthophosphate, and total phosphorus), total and dissolved metals (aluminum arsenic, cadmium, chromium, copper, iron, lead, manganese, nickel, selenium, and zinc), total recoverable mercury, total methyl mercury, total and dissolved solids, total hardness, settleable and suspended materials (solids), color, floating material, oil and grease, taste and odor, and total and dissolved organic carbon
d. includes chlorinated organic pesticides, organic phosphorus pesticides, chlorinated phenoxy acid herbicides, volatile organic pesticides, carbamate pesticides, and glyphosate.
e. m = monthly measurement or sample collection
f. F = fall (after significant runoff), W = winter (after dormant spray season)
g. nutrients, field parameters, and periphyton at two week intervals from September through December
i. surface samples
l. benthic macroinvertebrate samples collected in September 2002
o. seasonal analysis of toxicity (July, September, first flush, February, April/May
p. spring and summer toxicity analyses
q. Sewerage Commission Oroville Region discharge 1/4 mile downstream from Afterbay Outlet
r. surface and bottom samples
s. surface, intake structure withdrawal elevation, and bottom
t. additional samples during four storm events

u. temperature and dissolved oxygen biweekly from May through October and monthly from November through April.

to warmer water and organic content in the Thermalito Afterbay. Water samples will be collected monthly for chemical analyses at the monitoring stations.

Inorganic chemical analyses will include minerals (calcium, sodium, potassium, magnesium, sulfate, chloride, boron, and alkalinity), nutrients (nitrate plus nitrite, ammonia, dissolved orthophosphate, and total phosphorus), metals (aluminum arsenic, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, selenium, and zinc), and total and dissolved organic carbon. For all metals except mercury, samples will be collected for both total recoverable and dissolved metals. Mercury will include both total recoverable and total methyl fractions. Total and suspended solids and hardness will also be analyzed from samples collected at each site. Analyses may also be conducted at other locations to determine sources of constituents found at the primary monitoring stations that may degrade the beneficial uses of the water.

Samples for chemical analyses from streams will be collected by wading into the channel and dipping sample containers to a depth of approximately one foot into the well-mixed channel flow. Mineral and nutrient samples will be collected into clean polyethylene containers. Samples for trace metals analyses at water quality criteria levels will be collected into polyethylene or glass bottles according to U.S. EPA Method 1669 (USEPA 1996). Samples for mineral, nutrient, and metal analyses from lakes and ponds will be collected from the surface by dipping an inverted container to approximately 0.5 meters below the surface. Water samples at greater depths will be collected with a van Dorn water bottle for minerals and nutrients and teflon bomb or Kemmerer style bottles for trace metals. Samples will be collected from near the surface and bottom of lakes and ponds during periods of stratification or when differences in field parameters occur between the surface and bottom, but only at mid-depth during those portions of the year when field parameters indicate uniform conditions throughout the water column in the shallower water bodies, such as Oroville Wildlife Area ponds.

Chemical analyses of minerals, nutrients, and metals will be performed at the DWR Bryte Chemical Laboratory in West Sacramento using U.S. EPA approved techniques, equipment, and methods (Appendix SPW1-1).

Pesticides—A variety of pesticides may be used within the watershed that may affect the aquatic resources in the Feather River watershed. Silviculture and agriculture pesticide uses are well regulated, but some application practices still contribute to pesticide contamination in streams and lakes. A significant source of pesticides in many areas has been identified as runoff from urbanized areas. Urban use of readily available household pesticides is unregulated and significantly more pesticides may be applied by homeowners than is applied for similar products by the regulated community.

Water samples will be collected from the monitoring stations in the fall after rains produce the first significant runoff and again during February or March. Samples will be analyzed at the Bryte Chemical Laboratory for chlorinated organic pesticides, organic phosphorus pesticides, chlorinated phenoxy acid herbicides, volatile organic pesticides, carbamate pesticides, and glyphosate.

Presently, the EPA has not approved methods for analyses of pyrethroid pesticides, though either GC-MS or HPLC methods have been used in various laboratories for their analyses. Since methods for analysis vary according to the specific pyrethroid pesticide, the Department of Pesticide Regulation will be contacted for a list of pyrethroid pesticides used within the watershed, including those that may replace diazinon and chlorpyrifos for home use by the public. Subsequently, suitable methods for analyses of these compounds will be identified and, if available, incorporated into the monitoring protocols.

Pathogens—Fecal coliform bacteria in aquatic ecosystems are indicative of fecal contamination. Though these bacteria generally do not themselves pose adverse risks, their presence indicates the possible presence of far more serious microorganisms, which may impact human health, and nutrient loading that may adversely affect the aquatic environment.

Bacteria levels will be screened monthly at the monitoring stations using membrane filter procedures for both fecal and total coliform bacteria. Analyses may be conducted at additional sites to identify sources of fecal contamination indicated by the presence of these bacteria. In addition, a focused coliform bacteria sampling program will be conducted. Selective stations at intensively used recreation areas, such as the North Forebay Recreation Area, will be monitored during a major holiday event (Independence or Labor day) according to requirements in the Basin Plan (i.e., not less than five samples for any 30-day period). This list of coliform sampling stations (approximately twelve) will be developed in consultation with SWRCB staff and other members of the Environmental Work Group.

Phytoplankton and Zooplankton—Phytoplankton form the basis of the food web in lakes and reservoirs. Phytoplankton respond to nutrient enrichment by increasing in numbers of organisms as well as type of organism dominance. Zooplankton subsequently graze on phytoplankton, and may exhibit changes in populations due to nutrient enrichment or contamination. Populations of these organisms vary throughout the year in response to environmental variables.

Both phytoplankton and zooplankton will be sampled from impounded project waters. Phytoplankton and zooplankton will be sampled with a Clark-Bumpus plankton net towed from 30 feet in depth to the surface in Lake Oroville, and from the bottom in the other impounded waters. Samples will be collected during monthly visits to the monitoring stations. Analyses of phytoplankton will include identification, enumeration, and chlorophyll determination. Zooplankton will be identified, enumerated, and measured volumetrically.

Periphyton—Periphyton are attached algae in streams that contribute to the basis of the food web along with organic input (e.g., leaves) from terrestrial sources. As with phytoplankton, periphyton also respond to nutrient enrichment by changes in types and abundance of species.

Periphyton will be sampled monthly from riffle substrates in streams. A cylindrical sampler will be used to enclose the periphyton, which will then be brushed from the substrate and aspirated into collection jars. Ten samples from each site will be composited. Analyses of the periphyton will include species identification and counts, and chlorophyll determination.

Aquatic Macroinvertebrates—Aquatic macroinvertebrates form the basis of the aquatic food web and are excellent indicators of long-term water quality conditions since specific communities develop in response to specific stream conditions and perturbations. The Department of Fish and Game modification (California Stream Bioassessment Procedure) of the U.S. EPA rapid bioassessment method (USEPA 1989) will be used to assess aquatic macroinvertebrates communities.

Decreasing reservoir levels during the summer results in exposure of former stream channels that may become habitat for fish and other aquatic organisms. Two to three riffle areas in each of these types of habitats in the major tributaries to Lake Oroville will be sampled in September of 2002 to determine the benthic community structure. Organisms will be collected using a kick screen and metal frame delineating a two square foot sampling area. Three transects will be established across each monitoring site. Three samples will be collected along each transect and combined into one sample, resulting in three samples per monitoring site. Organisms will be removed from samples using the DFG rapid bioassessment method protocols, identified to the lowest practical taxon (generally genus), and enumerated. The areas will again be sampled during the spring when the riffles are inundated to evaluate changes in aquatic macroinvertebrate composition. Spring samples will be collected with an Ekman dredge.

Habitat conditions downstream from major dams generally result in significant changes to macroinvertebrate community structure and function due to altered temperature, flow, food, and substrate regimes. Aquatic macroinvertebrates will be assessed at the monitoring stations in the Feather River upstream from Lake Oroville and downstream from the Fish Barrier Dam during September of 2002 to determine effects from Oroville Dam on community structure and function. Organisms will be collected from riffle substrate areas using a kick screen and metal frame delineating a two square foot sampling area. Two or three closely spaced riffles or one extensive riffle will be sampled at each monitoring station. Three transects will be established across each monitoring site. Three samples will be collected along each transect and combined into one sample, resulting in three samples per monitoring station. Organisms will be removed from samples following the DFG rapid bioassessment method protocols, identified to the lowest practical taxon (generally genus), and enumerated at the DWR Aquatic Macroinvertebrate Laboratory in Red Bluff.

Aquatic macroinvertebrates will be sampled in four ponds in the Oroville Wildlife Area using an Ekman dredge. Ten dredged samples will be collected from areas within a pond and composited Samples will be processed using procedures similar to those for samples collected from the Feather River.

Stream Sediments—Sedimentation is a major impairment in many streams, including those upstream from Lake Oroville. Fine sediments in gravels adversely affect salmonid reproduction and survival of aquatic macroinvertebrates and other organisms that are important as food for fish.

Stream gravels from riffle areas will be analyzed for laboratory determination of particle size distribution in study plan SP-G2, Task 2.

Aquatic Toxicity—The direct measurement of toxicity to aquatic organisms of stream water may be indicative of the ability of the stream to support aquatic life. The Basin Plan has an objective that "all waters shall be maintained free of toxic substances in concentrations that produce detrimental physiological responses … in aquatic life." The Basin Plan stipulates that "compliance with this objective shall be determined by … biotoxicity tests." Water column toxicity assessment will be used to identify direct impacts to fish and zooplankton from toxic substances that may be either dissolved or suspended in the water column.

Water column toxicity testing will use *Ceriodaphnia* and the fathead minnow. Toxicity tests will measure survival and growth for the minnow, and reproduction and survival of Ceriodaphnia over a seven-day test period (USEPA 1994). Water samples will be analyzed during the high temperature months of July and September, following the first flush in the fall, following winter dormant spraying in February, and again during the high runoff period in April or May in tributaries to Lake Oroville. Samples will be analyzed monthly for toxicity analyses from the monitoring sites downstream from the Fish Barrier Dam to Honcut Creek. If significant toxicity is detected at these sites, identification of the causative agent for the toxicity will be attempted through toxicity identification evaluation procedures. Additional analyses will also be conducted at sites further downstream to determine the extent of project related effects. Several Oroville Wildlife Area ponds will be sampled in the spring and again in mid-summer. Toxicity tests will be conducted at the Pacific EcoRisk Laboratory or U.C. Davis Toxicology Laboratory.

Settleable and Suspended Material—Settleable and suspended materials in water may affect the beneficial uses of water and impart an aesthetically unpleasant appearance. Suspended materials may interfere with respiration of fish and other aquatic organisms, while settleable materials may smother eggs of fish and benthic organisms.

Water samples will be collected for settleable and suspended materials analyses during monthly visits to the sites designated for inorganic chemistry analyses. Setteable materials will be determined by settling the water sample in an Imhoff cone, while suspended material will be determined by filtration.

Color—Color is defined as either true or apparent color. True color in water may result from the presence of metallic ions, humus and peat materials, plankton, weeds, and industrial wastes in solution, while apparent color includes the effects from turbidity caused by suspended materials.

Water samples will be collected for color analyses during monthly visits to the sites designated for inorganic chemistry analyses. Color will be determined by comparing samples filtered to remove apparent color to calibrated glass disks (colorimetry).

Floating Material and Oil and Grease—The Basin Plan stipulates that floating material shall not be present in amounts that cause nuisance or adversely affect beneficial uses, and that oil, grease, waxes, or other materials shall not be present in concentrations that cause nuisance, result in a visible film or coating on the surface of the water or on objects in the water, or otherwise adversely affect beneficial uses.

Floating materials and oil and grease will be determined through visual observation during each visit to each monitoring site. Floating materials will be estimated as a percent cover of the water. If oil, grease, or related compound are sighted, water samples will be collected for laboratory determination of the type of compound.

Tastes and Odors—The Basin Plan states that water shall not contain taste or odor producing substances in concentrations that impart undesirable tastes or odors to domestic or municipal water supplies or to fish flesh or other edible products of aquatic origin, or that cause nuisance or otherwise adversely affect beneficial uses. Sampling water for taste requires that a sample be taken into the mouth for sensory analysis. However, raw water is not safe for taste testing due to the potential presence of bacteria, viruses, hazardous chemicals, and other factors. Therefore, water from the project area will not be subjected to taste tests. However, aquatic organisms (fish and crayfish) sampled for other studies during the spring (i.e., SP-W6) will be obtained for determination of any undesirable taste to the edible portion of these organisms.

Water can be analyzed for odor simply by smelling a sample. At least two individuals will smell water samples from each site visit to determine the presence of odors. The samplers will describe the type of any odor detected to attempt determination of the causative agent.

Specific Effects Analyses—Some aspects of the project may have water quality effects related to specific parameters or require additional monitoring for specific parameters. As these potential effects are identified in this or other studies or information from the public or other agencies, appropriate monitoring programs will be developed to evaluate their significance.

An issue that has been raised is the effect of the unnatural concentration of carcasses from over 100,000 salmon that spawn each year in the low flow section of the Feather River. Following spawning, the salmon die and begin decomposition. The decomposition process provides food for scavenger macroinvertebrates, bacteria, and other animals. Decomposition releases nutrients that may be used by periphyton and higher plants, but also may decrease oxygen levels in the water and contribute ammonia which is toxic to aquatic life, including fish eggs and fry, in sufficiently high concentration. Reduced oxygen and elevated ammonia levels may contribute to the low egg survival identified in the IIP in the upper river. Additional nutrient and periphyton monitoring will be conducted at two week intervals from September through December at the monitoring sites within the project boundary downstream from the Fish Barrier Dam to Honcut Creek to determine effects from decomposing salmon carcasses. Dissolved oxygen levels, as well as temperature, conductivity and pH, in the water and within the gravels will be measured with field instruments or recorders at several of these sites. Subsequently, the data will be reviewed by the Environmental Workgroup to determine the need to continue this monitoring past December.

Additional nutrients and other waste treatment byproducts are discharged to the Feather River a quarter mile downstream from the Afterbay Outlet by the Sewerage Commission Oroville Region, which treats sewage from the Oroville area. Monitoring of nutrients, periphyton, dissolved oxygen, temperature, conductivity, and pH in the water and within the gravels will be conducted with field instruments at monthly intervals or recorders in the Feather River upstream and downstream from the SCOR discharge.

Task 2—Project Effects on Water Quality Objectives

Data for this analysis will be obtained from Task 1. The data will be evaluated for compliance to applicable criteria and objectives for protection of beneficial uses, most of which have been summarized by the CVRWQCB (CVRWQCB 2000). The CVRWQCB has established numerical objectives for parameters which can be measured quantitatively (such as mg/L of a chemical contaminant) and narrative objectives for parameters that are not readily quantifiable. Both numerical and narrative objectives are applicable in determining impacts to beneficial uses. The criteria and objectives used for evaluating the data include:

numerical and narrative objectives identified in the CVRWQCB Basin Plan;
criteria of the U.S. EPA California Toxics Rule (USEPA 1998);
criteria of the National Recommended Water Quality Criteria (USEPA 1999);
criteria of the nutrient criteria guidance Documents (USEPA 2000a);
drinking water standards and health advisories (USEPA 2000b);
drinking water criteria (CDHS 2000a);
agriculture water quality (Ayers and Westcot 1985);
draft bacterial limits guidelines (CDHS 2000b); and
contaminant action levels established by the California Office of Environmental Health Hazard Assessment.

Task 3—Project Effects on Designated Beneficial Uses

Information for this analysis will be obtained from Task 2. Compliance with numerical and narrative water quality objectives will be evaluated to determine project effects to designated beneficial uses. Designated beneficial uses potentially affected by parameters that do not meet water quality objectives will be identified in this study. A summary table will be prepared showing designated beneficial uses, water quality criteria or objectives, and range of values obtained from the study. In addition, a report will be prepared discussing results, compliance issues, and potential mitigation.

Task 4. Effects from Future Project Operations

As the Engineering and Operations Workgroup identifies potential future operations of the project that differ from those currently experienced, potential effects to water quality and beneficial uses from those operations will be evaluated in this study.

Task 5. Progress Report—A progress report will be prepared at the conclusion of the first year of study. Interim output products will be identified through coordination with other workgroups to meet their data needs.

Task 6. Final Report—A final report will be prepared following completion of the second year of the study.

6.0 Results and Products/Deliverables

Results

Results from this study will be presented in a detailed report that evaluates effects of the project to water quality. Data obtained from this study will be compared to applicable numerical and narrative water quality objectives and criteria established for the protection of beneficial uses. Data obtained from the study will be presented in tables and graphs depicting concentrations of the various parameters and associated criteria. The graphs will illustrate variations in parameter concentrations throughout the period of collection. Parameters that exceed criteria will also be compared in graphs to concentrations of associated parameters, such as metal concentration association with turbidity levels, to help understand potential causes of elevated parameters. Temperature data from study plan SP-W6 will be summarized in tables and graphs depicting conditions in the Feather River downstream from Oroville Dam, and will illustrate daily maximum and minimum and mean daily temperature variations (based on 15-minute data collected to compute hourly values).

Compliance with water quality objectives will be used to evaluate effects on designated beneficial uses for Lake Oroville and the Feather River downstream from the Fish Barrier Dam as defined in the Basin Plan. The beneficial uses include municipal and domestic supply, agriculture, electrical power production, contact and non-contact recreation, warm-water and cold-water fish spawning, rearing and migration, warm and cold freshwater habitat, and wildlife habitat. Designated beneficial uses potentially affected by parameters that do not meet water quality objectives will be identified. Water quality data within the project area will be compared with that for waters entering the project as well as downstream from the project to determine whether the project has any affect on water quality objectives. The data from this study will also be used to evaluate effects to water quality of any proposed operational alternatives.

Aquatic macroinvertebrate data will be analyzed using various metrics to determine the health of this component of the aquatic ecosystem. Metrics used to evaluate the data will include organism abundance, taxa richness, species diversity and equitability, modified Hilsenhoff Biotic Index, ratio of scraper and filtering collector functional feeding groups, ratio of EPT (Ephemeroptera, Plecoptera, Tricoptera) and Chironomidae abundances, percent contribution of dominant taxon, and ratio of shredder functional feeding group and total number of individuals (USEPA 1989). The data will also be used to evaluate the effects of the dam on downstream community structure and function due to altered temperature, flow, and food regimes, effects of relatively sudden flow changes (ramping) on stranding macroinvertebrates and contributing to catastrophic drift, and effects of concentrated salmon spawning in the low flow section. Benthic macroinvertebrate community species composition and structure will be compared upstream and downstream from potential impacts to assess effects. Comparisons will include tables and graphs comparing various metrics used to analyze community structure. Literature information on substrate size, flow, and depth preferences will be reviewed and an assessment made for effects in the Feather River using habitat information from Study #G2 and Study #F10.

Toxicity test results will be used to identify parameters that may be adversely affecting aquatic life. The data will be presented in tables and graphs showing levels of toxicity during the monitoring period.
Information derived from this study will be used by the SWRCB to determine conditions in the water quality certification to comply with Section 401 of the Federal Clean Water Act. Information from this study will also be used by others in the Environmental, Recreation and Socioeconomics and Land Use, Land Management and Aesthetics Work Groups.

7.0 Coordination and Implementation Strategy

Coordination with Other Resource Areas/Studies

This study plan will also provide most of the data needed in study plan SP-W4 for evaluation of effects of the hatchery to water quality, and will be coordinated with water quality studies in study plan SP-W3 for evaluation of recreation facilities and activities on water quality. Temperature data from study plan SP-W6 will provide information to this study plan for evaluation of effects to water temperature beneficial use designations. This study will rely on sediment information collected in study plan SP-G2. Study plan SP-W5 will provide information for determination of project effects to groundwater.

Issues

This study plan provides the information for evaluation of Issue Statements W1 (project effects on designated beneficial uses), W2 (project effects on water quality objectives), and W3 (project effects on Feather River and tributaries), and will provide information for determination of project compliance with water quality standards and other appropriate requirements in the application for water quality certification. This study fully or partially addresses the following Stakeholder issues:

Stakeholder issues fully addressed by SP-W1 Project Effects on Water Quality Designated Beneficial Uses for Surface Waters

- WE1. Look at project effects on all designated beneficial uses of the waterway
- WE2. Water quality objectives, including levels for bacteria, chemical constituents, dissolved oxygen, pH, oil and grease, pesticides, sediment, temperature, toxicity, and turbidity will be evaluated for compliance with the Basin Plan standards
- WE3. General concerns include all parameters of water quality as flow enters the project boundaries, passes through facility features, and discharges downstream. Direct and indirect effects of the project on aquatic ecosystem health, on recreational opportunity, and on domestic and agricultural supply will be considered
- WE4. Specific issues will need to be addressed for the issuance of 401 Certification and for disclosure in the Applicant Prepared Environmental Assessment
- WE10. Maintain or improve water quality to protect beneficial uses and meet or exceed State objectives.
- WE24. Warm water release requirements for agricultural production
- WE30. Are dissolved oxygen levels in the Feather River from Thermalito Afterbay to Live Oak a problem during the spring, summer, and fall months
- WE31. How have turbidity levels been affected by project operation
- WE32. Thermalito Afterbay acts as a thermal retention basin for project water prior to delivery to water districts outside the project boundary. How do releases from this water body affect the stream temperature and dissolved oxygen content of Feather River receiving waters.
- WE33. Relationship between hatchery and water quality
- WE47. Effects of lake level changes on cultural resources due to water quality contaminants
- WE48. Macroinvertebrates as an indicator of water quality
- WE50. Conversion from lotic to lentic environment and accompanying changes in water quality

- WE53. Consider water quality downstream of Oroville facilities and the effect of low flows on dilution of contaminants entering the Feather River downstream
- FE36. Under existing conditions, does the diversity and abundance of benthic macroinvertebrates in the low-flow section and in the river downstream of Thermalito Afterbay suggest a healthy stream channel;
- FE83. Macroinvertebrates as an indicator of water quality;

Stakeholder issues partially addressed by SP-W1 Project Effects on Water Quality Designated Beneficial Uses for Surface Waters

- WE19. Is the availability of a cold-water pool in Lake Oroville adequate under present and future operational demands to meet the existing downstream cold fresh-water habitat requirements of steelhead and fall, late-fall, and spring-run Chinook salmon
- WE25. Does the present temperature model have the ability to forecast average daily water temperatures, under present and future operational demands, in the low-flow channel and in the river from the Thermalito Afterbay outlet down to Verona
- WE36. Both cold-water and warm-water habitat, spawning, and migration uses have been designated for surface waters potentially affected by the project. A determination must be made as to the specific thermal habitat that may be reasonably provided in each water body within project boundaries and downstream of the project
- WE37. Dredging of lower river to make suitable fish habitat
- WE40. Minimum level of draw-down effect on water temps
- WE46. Spawning habitat in tributaries as they relate to operations
- WE54. Impact of project structures and operations on water quality conditions necessary to sustain anadromous salmonids and their habitat. Adequacy of current project operating regimes and structures to optimize water quality conditions for anadromous salmonids and their habitats.
- F1. Effects of existing and future project operations (including power generation, water storage, ramping rates, and releases, pump-back, water levels, and water level fluctuations) during all water year types on the behavior (e.g., migration timing, microhabitat selection, vulnerability to predators), reproduction, survival and habitat of warm- and cold-water fish and other aquatic resources (e.g., macroinvertebrates), which include in project waters and tributaries within the project boundaries (Lake Oroville, Diversion Pool, Fish Barrier Pool, Forebay, Afterbay, Oroville Wildlife Area), and in project affected waters
- F6. Effects of existing and future project operations on sediment deposition, erosion, and recruitment through the system (including downstream sediment supply) and associated changes in water quality on the quantity and quality of aquatic habitats within project affected waters
- FE64. Effect of project on available upstream fishery habitat (Incorporate all project facilities)
- FE89. Impact of project structures and operations on water quality conditions necessary to sustain anadromous salmonids and their habitats;
- FE96. The lower Feather River provides habitat to support a variety of resident native and resident introduced species including coldwater species such as rainbow, brook, and brown trout, and warm water species such as bass, catfish, bluegill, green sunfish, carp and others. Potential changes in license conditions could adversely impact habitat supporting these species or upset habitat conditions

such that less desirable species are favored. Habitat investigations should evaluate the existing quality and quantity of habitat and determine alternative improvements for the various life history needs of these resident native and non-native species including flow, water temperature, instream and riparian cover, substrate and spatial area;

- FE97. The habitat for fishes in the lower Feather River is affected by the flow releases from the project. Seasonal timing, volume, and rate of release all have an affect on fish habitat conditions. Potential changes in license conditions for flow releases could adversely affect habitat conditions for one or more fish species. Fishery investigations should examine the adequacy of flows for maintaining all life history needs for anadromous and resident species. There should be evaluation of potential for flow improvements in the low-flow section. Fishery investigations should be sufficient to determine how best to meet the combined needs of the various anadromous and resident fish species;
- T1. Effects of project features, existing and future operations (including power generation, water storage and releases, ramping rates, pump-back, water levels and water level fluctuations) and maintenance on wildlife and wildlife habitat. Specific concerns include deer winter range, band-tailed pigeon winter habitat, designated emphasis and harvest species, wintering and nesting waterfowl, and other wildlife use of project and project-affected waters.

8.0 Study Schedule

Monitoring for Task 1 of the study will begin in March of 2002 and continue for two years. Subsequently, data will be analyzed for completion of Tasks 2, 3, and 4. Information developed will be presented quarterly to the Environmental Workgroup and Task Force for review to evaluate the adequacy and progress of the study. A progress report will be prepared in early 2003 after completion of the first year of monitoring. The progress report will review results, evaluate the adequacy of the monitoring program, and recommend changes to the second year of the monitoring program, which may include reduction or elimination of certain parameters and addition or increased frequency of monitoring for others. A draft final report discussing results of the two-year study will be prepared by June of 2004.

9.0 References

Ayers, R. S. and D. W. Westcot. Water quality for agriculture, Food and Agriculture Organization of the United Nations – Irrigation and drainage paper No. 29, Rev. 1

CDHS 2000a. California domestic water quality and monitoring regulations. California Code of Regulations, Title 22, Division 4, Chapter 15

CDHS 2000b. Draft guidance for fresh water beaches. California Department of Health Services, Sacramento

CVRWQCB 1998. The Water Quality Control Plan (Basin Plan) for the California Regional Water Quality Control Board, Central Valley Region, Fourth edition. The Sacramento River Basin and the San Joaquin River Basin. CVRWQCB, Sacramento

CVRWQCB 2000. A compilation of water quality goals. California Regional Water Quality Control Board, Central Valley Region

DWR 2001. Initial Information Package for Relicensing of the Oroville Facilities. Federal Energy Regulatory Commission License Project No. 2100. Department of Water Resources, Sacramento

USEPA 1989. Rapid bioassessment protocols for use in streams and rivers, benthic macroinvertebrates and fish. EPA/440/4-89/001

USEPA 1994. Short-term methods for estimating the chronic toxicity of effluents and receiving water to freshwater organisms. Third edition. EPA-600-4-91-002

USEPA 1996. Method 1669: Sampling ambient water for trace metals at EPA water quality criteria levels. EPA-821-R-96-008

USEPA 1998. Water quality standards; establishment of numeric criteria for priority toxic pollutants for the State of California; Rule. Federal Register 40 CFR Part 131, May 2000

USEPA 1999. Compilation of national recommended water quality criteria. EPA-822-F-98-006

USEPA 2000a. Nutrient criteria technical guidance manual. Rivers and streams EPA-822-B-00-002 and Lakes and reservoirs EPA-822-B-00-001

USEPA 2000b. Drinking water standards and health advisories. EPA-822-B-00-001

10. Appendices

Appendix SPW1-1. Analytical methods and detection levels for sampling schedule in Table SPW1-2

Method	Analysis	Units	Reporting Limit
Minerals			
EPA 200 7 (D)	Dissolved Calcium	mg/L	1
EPA 200.7 (D)	Dissolved Sodium	mg/L	1
EPA 200.7 (D)	Dissolved Potassium	mg/L	0.5
EPA200.7 (D)	Dissolved Magnesium	mg/L	1
EPA 300.0 (28d hold)	Dissolved Sulfate	mg/L	1
EPA 300.0 28d Hold	Dissolved Chloride	mg/L	1
EPA 200.7 (D)	Dissolved Boron	mg/L	0.1

Std Method 2320 B	Alkalinity	mg CaCO3/L	0.1
Nutrients			
Std Method 4500-NO3-F Modified	Dissolved Nitrite + Nitrate	mg/L as N	0.05
EPA 350.1	Dissolved Ammonia	mg/L as N	0.02
Std Method 4500-NH3	Total Ammonia	mg/L as N	0.02
EPA 365.1	Dissolved Ortho-phosphate	mg/L as P	0.01
EPA 365.4	Total Phosphorus	mg/L	0.01
Metals			
EPA 1631	Total Mercury	µg/L	0.0002
EPA 1631	Total Methyl Mercury	µg/L	0.005
EPA 1631	Dissolved Methyl Mercury	ug/L	0.005
EPA 1632	Total and Dissolved Arsenic	µg/L	0.004
Std Method 3500-Fe D	Total and Dissolved Iron	µg/L	2.2
EPA 1638	Total and Dissolved Aluminum	µg/L	0.4
EPA 1638	Total and Dissolved Cadmium	µg/L	0.003
EPA 1638	Total and Dissolved Chromium	µg/L	0.03
EPA 1638	Total and Dissolved Copper	µg/L	0.01
EPA 1638	Total and Dissolved Lead	µg/L	0.005
EPA 1638	Total and Dissolved Manganese	µg/L	0.02
EPA 1638	Total and Dissolved Nickel	µg/L	0.01
EPA 1638	Total Selenium	µg/L	0.1
EPA 1638	Total and Dissolved Zinc	µg/L	0.03
Miscellaneous Parameters			
Std Method 2540 D	Total Suspended Solids (Suspended material)	mg/L	1
Std Method 2540 C	Total Dissolved Solids	mg/L	1
Std Method 2540 F	Settleable Solids (Settleable material)	Mg/L	1
Std Method 2340 B	Hardness	mg/L as CaCO3	1
Std Method 5520	Oil and Grease	mg/L	
Std Method 2550 B 1, 2	Temperature	degree Celcius	0.1
Std Method 4500-O C	Dissolved oxygen	mg/L	0.1
Std Method 4500-H+ B	pH	pH units	0.1
Std Method 2510 B	Conductivity	umhos/cm	0.1
EPA 445.0	Chlorophyll	µg/L	
EPA 600-4-91-002	Toxicity		

Std Method 2120 B	Color	Units	1
Std Method 2150/2160	Taste and Odor	-	-
EPA 415.1 (D)	Dissolved Organic Carbon		
Pathogens			
Std Method 9222 B	Total Coliform bacteria	colonies/100 mL	0
Std Method 9222 D	Fecal Coliform bacteria	colonies/100 mL	0
Table SPW1-3. Analytical methods and detection levels, continued			
Pesticides			
Chlorinated Organic Pesticides			
EPA 508	Alachlor	µg/L	0.05
EPA 508	Aldrin	µg/L	0.01
EPA 508	Atrazine	µg/L	0.02
EPA 508	BHC-alpha	µg/L	0.01
EPA 508	BHC-beta	µg/L	0.01
EPA 508	BHC-delta	µg/L	0.01
EPA 508	BHC-gamma (Lindane)	µg/L	0.01
EPA 508	Captan	µg/L	0.02
EPA 508	Chlordane	µg/L	0.05
EPA 508	Chlorothalonil	µg/L	0.01
EPA 508	Chlorpropham	µg/L	0.02
EPA 508	Chlorpyrifos	µg/L	0.01
EPA 508	Cyanazine	µg/L	0.3
EPA 508	Dacthal (DCPA)	µg/L	0.01
EPA 508	Dichloran	µg/L	0.01
EPA 508	Dicofol	µg/L	0.05
EPA 508	Dieldrin	µg/L	0.01
EPA 508	Diuron	µg/L	0.25
EPA 508	Endosulfan sulfate	µg/L	0.02
EPA 508	Endosulfan-I	µg/L	0.01
EPA 508	Endosulfan-II	µg/L	0.01
EPA 508	Endrin	µg/L	0.01
EPA 508	Endrin aldehyde	µg/L	0.01
EPA 508	Heptachlor	µg/L	0.01

EPA 508	Heptachlor epoxide	µg/L	0.01
EPA 508	Methoxychlor	µg/L	0.05
EPA 508	Metolachlor	µg/L	0.2
EPA 508	Oxyfluorfen	µg/L	0.2
EPA 508	p,p'-DDD	µg/L	0.01
EPA 508	p,p'-DDE	µg/L	0.01
EPA 508	p,p'-DDT	µg/L	0.05
EPA 508	PCB-1016	µg/L	0.1
EPA 508	PCB-1221	µg/L	0.1
EPA 508	PCB-1232	µg/L	0.1
EPA 508	PCB-1242	µg/L	0.1
EPA 508	PCB-1248	µg/L	0.1
EPA 508	PCB-1254	µg/L	0.1
EPA 508	PCB-1260	µg/L	0.1
EPA 508	Pentachloronitrobenzene (PCNB)	µg/L	0.01
EPA 508	Ronnel	µg/L	0.3
EPA 508	Simazine	µg/L	0.02
EPA 508	Thiobencarb	µg/L	0.02
EPA 508	Toxaphene	µg/L	0.4
EPA 508	Trifluralin	µg/L	0.05
Organic Phosphorus Pesticides			
EPA 508	Azinphos methyl (Guthion)	µg/L	0.05
EPA 508	Benfluralin	µg/L	0.01
EPA 508	Bromacil	µg/L	1
EPA 508	Carbophenothion (Trithion)	µg/L	0.02
EPA 508	Chlorpyrifos	µg/L	0.01
EPA 508	Cyanazine	µg/L	0.3
EPA 508	Demeton (Demeton O + Demeton S)	µg/L	0.02
EPA 508	Diazinon	µg/L	0.01
EPA 508	Dimethoate	µg/L	0.01
EPA 508	Disulfoton	µg/L	0.01
EPA 508	Ethion	µg/L	0.01
EPA 508	Malathion	µg/L	0.01
EPA 508	Methidathion	µg/L	0.02
EPA 508	Mevinphos	µg/L	0.01
EPA 508	Naled	µg/L	0.02
EPA 508	Napropamide	µg/L	5

EPA 508	Norflurazon	µg/L	5
EPA 508	Parathion (Ethyl)	µg/L	0.01
EPA 508	Parathion, Methyl	µg/L	0.01
EPA 508	Pendimethalin	µg/L	5
EPA 508	Phorate	µg/L	0.01
EPA 508	Phosalone	µg/L	0.02
EPA 508	Phosmet	µg/L	0.02
EPA 508	Profenofos	µg/L	0.01
EPA 508	Prometryn	µg/L	0.05
EPA 508	Propetamphos	µg/L	0.1
EPA 508	Ronnel	µg/L	0.01
EPA 508	s,s,s-Tributyl Phosphorotrithioate (DEF)	µg/L	0.01
EPA 508	Trifluralin	µg/L	0.01
Volatile Organics (Purgeable)			
EPA 502.2	1,1,1,2-Tetrachloroethane	µg/L	0.5
EPA 502.2	1,1,1-Trichloroethane	µg/L	0.5
EPA 502.2	1,1,2,2-Tetrachloroethane	µg/L	0.5
EPA 502.2	1,1,2-Trichloroethane	µg/L	0.5
EPA 502.2	1,1-Dichloroethane	µg/L	0.5
EPA 502.2	1,1-Dichloroethene	µg/L	0.5
EPA 502.2	1,1-Dichloropropene	µg/L	0.5
EPA 502.2	1,2,3-Trichlorobenzene	µg/L	0.5
EPA 502.2	1,2,3-Trichloropropane	µg/L	0.5
EPA 502.2	1,2,4-Trichlorobenzene	µg/L	0.5
EPA 502.2	1,2,4-Trimethylbenzene	µg/L	0.5
EPA 502.2	1,2-Dibromo-3-chloropropane (DBCP)	µg/L	0.5
EPA 502.2	1,2-Dibromoethane	µg/L	0.5
EPA 502.2	1,2-Dichlorobenzene	µg/L	0.5
EPA 502.2	1,2-Dichloroethane	µg/L	0.5
EPA 502.2	1,2-Dichloropropane	µg/L	0.5
EPA 502.2	1,3,5-Trimethylbenzene	µg/L	0.5
EPA 502.2	1,3-Dichlorobenzene	µg/L	0.5
EPA 502.2	1,3-Dichloropropane	µg/L	0.5
EPA 502.2	1,4-Dichlorobenzene	µg/L	0.5
EPA 502.2	2,2-Dichloropropane	µg/L	0.5
EPA 502.2	2-Chlorotoluene	µg/L	0.5
EPA 502.2	4-Chlorotoluene	µg/L	0.5

EPA 502.2	4-Isopropyltoluene	µg/L	0.5
EPA 502.2	Benzene	µg/L	0.5
EPA 502.2	Bromobenzene	µg/L	0.5
EPA 502.2	Bromochloromethane	µg/L	0.5
EPA 502.2	Bromodichloromethane	µg/L	0.5
EPA 502.2	Bromoform	µg/L	0.5
EPA 502.2	Bromomethane	µg/L	0.5
EPA 502.2	Carbon tetrachloride	µg/L	0.5
EPA 502.2	Chlorobenzene	µg/L	0.5
EPA 502.2	Chloroethane	µg/L	0.5
EPA 502.2	Chloroform	µg/L	0.5
EPA 502.2	Chloromethane	µg/L	0.5
EPA 502.2	cis-1,2-Dichloroethene	µg/L	0.5
EPA 502.2	cis-1,3-Dichloropropene	µg/L	0.5
EPA 502.2	Dibromochloromethane	µg/L	0.5
EPA 502.2	Dibromomethane	µg/L	0.5
EPA 502.2	Dichlorodifluoromethane	µg/L	0.5
EPA 502.2	Ethyl benzene	µg/L	0.5
EPA 502.2	Fluorobenzene	µg/L	0.5
EPA 502.2	Hexachlorobutadiene	µg/L	0.5
EPA 502.2	Isopropylbenzene	µg/L	0.5
EPA 502.2	m + p Xylene	µg/L	0.5
EPA 8260	Methyl tert-butyl ether (MTBE)	µg/L	0.5
EPA 502.2	Methylene chloride	µg/L	0.5
EPA 502.2	n-Butylbenzene	µg/L	0.5
EPA 502.2	n-Propylbenzene	µg/L	0.5
EPA 502.2	Naphthalene	µg/L	0.5
EPA 502.2	o-Xylene	µg/L	0.5
EPA 502.2	sec-Butylbenzene	µg/L	0.5
EPA 502.2	Styrene	µg/L	0.5
EPA 502.2	tert-Butylbenzene	µg/L	0.5
EPA 502.2	Tetrachloroethene	µg/L	0.5
EPA 502.2	Toluene	µg/L	0.5
EPA 502.2	trans-1,2-Dichloroethene	µg/L	0.5
EPA 502.2	trans-1,3-Dichloropropene	µg/L	0.5
EPA 502.2	Trichloroethene	µg/L	0.5
EPA 502.2	Trichlorofluoromethane	µg/L	0.5
EPA 502.2	Vinyl chloride	µg/L	0.5

Chlorinated Phenoxy Acid Herbicides			
EPA 515.1	2,4,5-T	µg/L	0.1
EPA 515.1	2,4,5-TP (Silvex)	µg/L	0.1
EPA 515.1	2,4-D	µg/L	0.1
EPA 515.1	2,4-DB	µg/L	0.1
EPA 515.1	2,4-Dichlorophenylacetic acid (DCAA)	µg/L	0.1
EPA 515.1	Dacthal (DCPA)	µg/L	0.1
EPA 515.1	Dicamba	µg/L	0.1
EPA 515.1	Dichlorprop	µg/L	0.1
EPA 515.1	Dinoseb (DNPB)	µg/L	0.1
EPA 515.1	MCPA	µg/L	0.1
EPA 515.1	MCPP	µg/L	0.1
EPA 515.1	Pentachlorophenol (PCP)	µg/L	0.1
EPA 515.1	Picloram	µg/L	0.1
EPA 515.1	Triclopyr	µg/L	0.1
Glyphosate			
EPA 547	Aminomethylphosphonic Acid (AMPA)	µg/L	100
EPA 547	Glyphosate	µg/L	100
Carbamate Pesticides			
EPA 531.1	3-Hydroxycarbofuran	µg/L	2
EPA 531.1	Aldicarb	µg/L	2
EPA 531.1	Aldicarb sulfone	µg/L	2
EPA 531.1	Aldicarb sulfoxide	µg/L	2
EPA 531.1	Carbaryl	µg/L	2
EPA 531.1	Carbofuran	µg/L	2
EPA 531.1	Formetanate hydrochloride	µg/L	100
EPA 531.1	Methiocarb	µg/L	4
EPA 531.1	Methomyl	µg/L	2
EPA 531.1	Oxamyl	µg/L	2
Pyrethrins	will be analyzed if a suitable method becomes available		